CORROSION RESISTANCE OF AISI 304 STEEL FROM COMPOSITIONAL OXIDE COATINGS

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One of the most dangerous types of corrosion destruction of high-alloy steels is the appearance of pits and ulcers on the surface of materials in certain industrial conditions. The most common cause of pits and ulcers is solutions containing chloride, bromide or hypochlorite ions, which, under favorable conditions, locally activate the surface. This form of corrosion is often more detrimental than general corrosion due to local dissolution, which can cause rapid penetration of metal thickness [1]. In many cases, such corrosion is not manifested until serious damage, such as through perforation of the material, in particular, the walls of tanks, plates of heat exchangers, pipelines, and can lead to production accidents, which will result in large material losses [2]. The solution to this problem is the formation of composite oxide coatings on metals and alloys [1, 2]. Modification of coatings by valve metals such as titanium, aluminum and others is known to provide materials with protective properties in harsh environments [1, 2]. Therefore, the development of oxide systems on the surface of AISI 304 steel with high corrosion characteristics, which would ensure the reliable operation of the equipment, is of great practical importance [2].

The purpose of this work is the electrochemical study of the resistance of stainless steel with oxide systems $Cr \cdot CrO_x$; $Cr \cdot CrO_x \cdot TiO_y$; $Cr \cdot CrO_x \cdot Al_xO_y$ in chloride medium.

The formation of composite oxide coatings was carried out in galvanostatic mode in a two-electrode cell with a system of continuous stirring at a current density of 50 A / dm^2 for 60 minutes in titanium, aluminum-containing electrolytes [2].

Tests for resistance to pitting corrosion of the obtained coatings were performed by the electrochemical method according to [3], which consists in the measurement of the free corrosion potential (E_{cor}) and the potentiodynamic polarization of the samples, followed by the determination of the pitting potentials (E_b - the potential of ping formation, the potential of base formation, pitting resistance (ΔE_b, ΔE_{rp}).

E_{cor} for AISI 304 steel is more electropositive than for composite materials, which indicates a significant change in the control of the corrosion process.The calculated electrochemical parameters ΔE_b and ΔE_{rp} indicate that the composite oxide coatings significantly increase the resistance to stainless steel. Studies on the surface morphology of samples after polarization using a ZEISSAxio metallographic microscope (×1000) digital video camera have shown that the composite materials have no defects, which is consistent with the results of electrochemical studies.

Composite oxide coatings significantly increase the alloy's resisting strength and thus provide reliable protection. The results of the study suggest that AISI 304 steel with $Cr \cdot CrO_x \cdot TiO_y$ oxide system has the highest pitting resistance.

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